

Amendment and Response

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Serial No.: 10/028,616

Confirmation No.: 6755

Filed: December 21, 2001

For: METHODS FOR PLANARIZATION OF GROUP VIII METAL-CONTAINING SURFACES USING A
FIXED ABRASIVE ARTICLE

Amendments to the Claims

This listing of claims replaces all prior versions, and listings, of claims in the above-identified application:

Listing of Claims

1. **(Currently Amended)** A planarization method comprising:
positioning a Group VIII metal-containing surface of a substrate to interface with a fixed abrasive article, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
supplying a planarization composition in proximity to the interface; and
planarizing the substrate surface with the fixed abrasive article;
wherein the fixed abrasive article comprises a plurality of abrasive particles having a hardness of no greater than about 6.5 Mohs dispersed within a binder adhered to at least one surface of a backing material;
wherein the method results in reduced smearing and defect formation on the planarized surface compared to planarizing the substrate the same method and surface planarized under the same conditions with a fixed abrasive article comprising alumina or silica particles instead of the particles having a hardness of no greater than about 6.5 Mohs.
2. **(Original)** The method of claim 1 wherein the Group VIII metal-containing surface of the substrate has a nonplanar topography.
3. **(Original)** The method of claim 1 wherein the Group VIII metal-containing surface of the substrate comprises a Group VIII metal in elemental form or an alloy thereof.

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4. **(Original)** The method of claim 3 wherein the Group VIII metal-containing surface comprises elemental platinum.
5. **(Original)** The method of claim 3 wherein the Group VIII metal-containing surface comprises a platinum alloy.
6. **(Original)** The method of claim 1 wherein the Group VIII metal is present in an amount of about 10 atomic percent or more.
7. **(Original)** The method of claim 6 wherein the Group VIII metal is present in an amount of about 20 atomic percent or more.
8. **(Original)** The method of claim 7 wherein the Group VIII metal is present in an amount of about 50 atomic percent or more.
9. **(Original)** The method of claim 1 wherein the substrate is a wafer.
10. **(Previously Presented)** The method of claim 1 wherein the plurality of abrasive particles are selected from the group consisting of CeO_2 , Y_2O_3 , Fe_2O_3 , and mixtures thereof.
11. **(Original)** The method of claim 10 wherein a majority of the plurality of abrasive particles are CeO_2 abrasive particles.
12. **(Original)** The method of claim 1 wherein the planarization composition comprises an oxidizing agent, a complexing agent, or mixtures thereof.

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13. **(Original)** The method of claim 1 wherein the Group VIII metal-containing surface is removed relative to a dielectric layer at a selectivity ratio of at least about 10:1.
14. **(Currently Amended)** A planarization method comprising:
- providing a semiconductor substrate or substrate assembly including at least one region of a platinum-containing surface;
 - providing a fixed abrasive article;
 - providing a planarization composition at an interface between the at least one region of platinum-containing surface and the fixed abrasive article; and
 - planarizing the at least one region of platinum-containing surface with the fixed abrasive article;
- wherein the fixed abrasive article comprises a plurality of abrasive particles having a hardness of no greater than about 6.5 Mohs dispersed within a binder adhered to at least one surface of a backing material;
- wherein the method results in reduced smearing and defect formation on the planarized surface compared to planarizing the substrate the same method and surface planarized under the same conditions with a fixed abrasive article comprising alumina or silica particles instead of the particles having a hardness of no greater than about 6.5 Mohs.
15. **(Original)** The method of claim 14 wherein the platinum-containing surface has a nonplanar topography.
16. **(Original)** The method of claim 14 wherein the platinum is present in an amount of about 10 atomic percent or more.
17. **(Original)** The method of claim 14 wherein the platinum-containing surface comprises elemental platinum.

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18. **(Original)** The method of claim 14 wherein the platinum-containing surface comprises a platinum alloy.
19. **(Original)** The method of claim 14 wherein the substrate assembly is a wafer.
20. **(Original)** The method of claim 14 wherein the plurality of abrasive particles comprise CeO_2 , Y_2O_3 , Fe_2O_3 , or mixtures thereof.
21. **(Original)** The method of claim 20 wherein a majority of the plurality of abrasive particles are CeO_2 abrasive particles.
22. **(Original)** The method of claim 14 wherein the planarization composition comprises an oxidizing agent, a complexing agent, or mixtures thereof.
23. **(Original)** The method of claim 14 wherein the Group VIII metal-containing surface is removed relative to an oxide layer at a selectivity ratio of at least about 10:1.
24. **(Currently Amended)** A planarization method comprising:
providing a semiconductor substrate or substrate assembly including at least one region of a platinum-containing surface having a nonplanar topography;
providing a fixed abrasive article;
providing a planarization composition at an interface between the at least one region of platinum-containing surface and the fixed abrasive article; and
planarizing the at least one region of platinum-containing surface with the fixed abrasive article;
wherein the fixed abrasive article comprises a plurality of abrasive particles selected from the group of CeO_2 , Y_2O_3 , Fe_2O_3 , and combinations thereof;

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wherein the method results in a higher rate of removal of material from the nonplanar
~~reduced smearing and defect formation on the planarized surface~~ compared to the rate of
removal of material from a generally planar or flat surface of the same material under the same
conditions ~~the same method and surface planarized with a fixed abrasive article comprising~~
~~alumina or silica particles.~~

25. **(Currently Amended)** A planarization method comprising:

providing a semiconductor substrate or substrate assembly including at least one region
of a platinum-containing surface having a nonplanar topography;

providing a fixed abrasive article;

providing a planarization composition at an interface between the at least one region of
platinum-containing surface and the fixed abrasive article; and

planarizing the at least one region of platinum-containing surface with the fixed abrasive
article;

wherein the fixed abrasive article comprises a plurality of CeO_2 abrasive particles;

wherein the method results in ~~reduced smearing and defect formation on the planarized~~
~~surface compared to the same method and surface planarized with a fixed abrasive article~~
~~comprising alumina or silica particles~~ a rate of removal that is at least about 10 times the rate of
removal of material from a generally planar or flat surface of the same material under the same
conditions.

26. **(Currently Amended)** A planarization method comprising:

providing a semiconductor substrate or substrate assembly including at least one region
of a platinum-containing surface having a nonplanar topography;

providing a fixed abrasive article;

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providing a planarization composition comprising an oxidizing agent, a complexing agent, or a combination thereof at an interface between the at least one region of platinum-containing surface and the fixed abrasive article; and

planarizing the at least one region of platinum-containing surface with the fixed abrasive article;

wherein the fixed abrasive article comprises a plurality of CeO_2 abrasive particles;

wherein the method results in ~~reduced smearing and defect formation on the planarized surface compared to the same method and surface planarized with a fixed abrasive article comprising alumina or silica particles~~ a rate of removal that is at least about 10 times the rate of removal of material from a generally planar or flat surface of the same material under the same conditions.

27. (Currently Amended) A planarization method for use in forming a capacitor or barrier layer:

providing a wafer having a patterned dielectric layer formed thereon and a Group VIII metal-containing layer formed over the patterned dielectric layer, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;

positioning a first portion of a fixed abrasive article for contact with the platinum-containing layer;

providing a planarization composition in proximity to the contact between the fixed abrasive and the Group VIII metal-containing layer; and

planarizing the Group VIII metal-containing layer with the fixed abrasive article;

wherein the fixed abrasive article comprises a plurality of abrasive particles having a hardness of no greater than about 6.5 Mohs dispersed within a binder adhered to at least one surface of a backing material;

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wherein the method results in reduced smearing and defect formation on the planarized surface compared to planarizing the substrate the same method and surface under the same conditions planarized with a fixed abrasive article comprising alumina or silica particles instead of the particles having a hardness of no greater than about 6.5 Mohs.

28. (Original) The method of claim 27 wherein the Group VIII metal-containing surface of the substrate comprises a Group VIII metal in elemental form or an alloy thereof.
29. (Original) The method of claim 28 wherein the Group VIII metal-containing surface comprises elemental platinum.
30. (Original) The method of claim 27 wherein the Group VIII metal-containing surface comprises a platinum alloy.
31. (Original) The method of claim 27 wherein the Group VIII metal is present in an amount of about 10 atomic percent or more.
32. (Original) The method of claim 31 wherein the Group VIII metal is present in an amount of about 20 atomic percent or more.
33. (Original) The method of claim 32 wherein the Group VIII metal is present in an amount of about 50 atomic percent or more.
34. (Cancelled)
35. (Original) The method of claim 27 wherein the plurality of abrasive particles comprise CeO_2 , Y_2O_3 , Fe_2O_3 , or mixtures thereof.

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36. **(Original)** The method of claim 35 wherein a majority of the plurality of abrasive particles are CeO₂ abrasive particles.
37. **(Original)** The method of claim 27 wherein the planarization composition comprises an oxidizing agent, a complexing agent, or mixtures thereof.
38. **(Original)** The method of claim 27 wherein the Group VIII metal-containing surface is removed relative to an oxide layer at a selectivity ratio of at least about 10:1.
39. **(Previously Presented)** A planarization method comprising:
positioning a Group VIII metal-containing surface of a substrate to interface with a fixed abrasive article, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof; wherein the surface of the substrate has a nonplanar topography;
supplying a planarization composition in proximity to the interface; and
planarizing the substrate surface with the fixed abrasive article to remove Group VIII metal-containing material;
wherein the fixed abrasive article comprises a plurality of abrasive particles having a hardness of no greater than about 6.5 Mohs dispersed within a binder adhered to at least one surface of a backing material; and
wherein the rate of removal of the Group VIII metal-containing material is greater than the rate of removal of material from a generally planar surface of the same material under the same conditions.
40. **(Previously Presented)** The method of claim 39 wherein the rate of removal of the Group VIII metal-containing material is at least about 10 times greater than the rate of removal of material from a generally planar surface of the same material under the same conditions.

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41. **(Previously Presented)** The method of claim 39 wherein the rate of removal of the Group VIII metal-containing material is at least about 25 times greater than the rate of removal of material from a generally planar surface of the same material under the same conditions.

42. **(Currently Amended)** A planarization method comprising:

positioning a Group VIII metal-containing surface of a substrate having a nonplanar topography to interface with a fixed abrasive article, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;

supplying a planarization composition in proximity to the interface; and

planarizing the substrate surface with the fixed abrasive article;

wherein the fixed abrasive article comprises a plurality of abrasive particles having a hardness of no greater than about 6.5 Mohs dispersed within a binder adhered to at least one surface of a backing material;

wherein the plurality of abrasive particles comprise CeO_2 , Y_2O_3 , Fe_2O_3 , or mixtures thereof; and

wherein the method results in ~~reduced smearing and defect formation on the planarized surface compared to the same method and surface planarized with a fixed abrasive article comprising alumina or silica particles~~ the selective removal of material from the Group VIII metal-containing surface having a nonplanar topography relative to an underlying oxide layer at a selectivity ratio of at least about 10:1.